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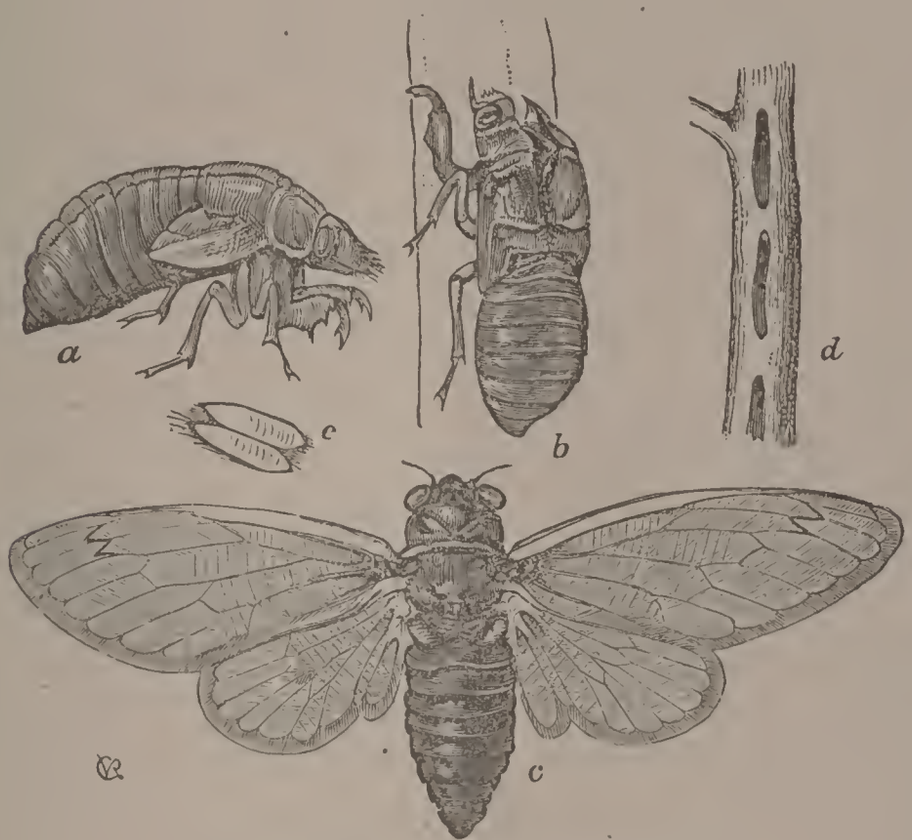
*The Seventeen Year Cicada* (Fig. 22, *a*, pupa; *b*, the same, showing the rent in the back out of which the adult, *c*, creeps; *d*, hole made by the ovipositor for the eggs, *e*, after Riley) in its early stages injures the roots of fruit trees by sucking the sap with its beak, while the fly in its peri odical visits deserts the oak trees, its natural food plant, and invades our orchards, causing by the deep stings of

FIG. 22.




Seventeen Year Cicada, eggs and pupa.

its large, powerful ovipositor the young twigs and small branches to wither and break off.

The most remarkable fact about this insect is that, while so far as we know the other species of Cicada pass but two or three years* in attaining the winged, adult state, the present one lives under ground over sixteen years, assuming towards the end of the seventeenth the winged state. We

*The European species of Cicada live three years, according to Haldeman.

have seen that the May beetle is about three years in attaining the beetle state, and the wire worm and boring beetles, such as the apple borer, may be three or four years in the larval condition, but no other insects are as yet known, with this sole remarkable exception, to be so long lived in their immature state.

The eggs of the Seventeen Year Cicada to the number of five hundred are laid in June, and about the middle of July, in the Middle States, the grubs (Fig. 23, greatly enlarged) are hatched. They escape into the ground from the twigs on the trees, and make their way to the smaller roots of the tree, burrowing a foot or two below the surface. When about to change to the winged state, they ascend to the surface, making cylindrical burrows "firmly cemented and varnished so as to be water proof."

FIG. 23.

Larva of Seventeen Year Cicada.

It should be here mentioned that certain broods of this species appear once in thirteen years, and this indicates that the ancestors of the present species went through their round of existence in two years, as in the other species. How the wonderful divergence in habits was brought about would form an exceedingly interesting subject of inquiry.

We are indebted to Dr. W. I. Burnett for an interesting suggestion concerning the chances of life in this insect, and this may give us some hints regarding the enormous waste, so to speak, of life (though after all it is an example of the economy of nature) involved in the struggle for existence among animals. Says our author, in a paper read at a meeting of the American Association for the Advancement of Science (Albany, 1851), "The female has about five hundred eggs, which, from certain relations of the other sex, which I

have made out microscopically, are probably all or nearly all fecundated. We have, then, for every two individuals which have appeared this year, a deposit of five hundred embryos for the generation to appear seventeen years hence.

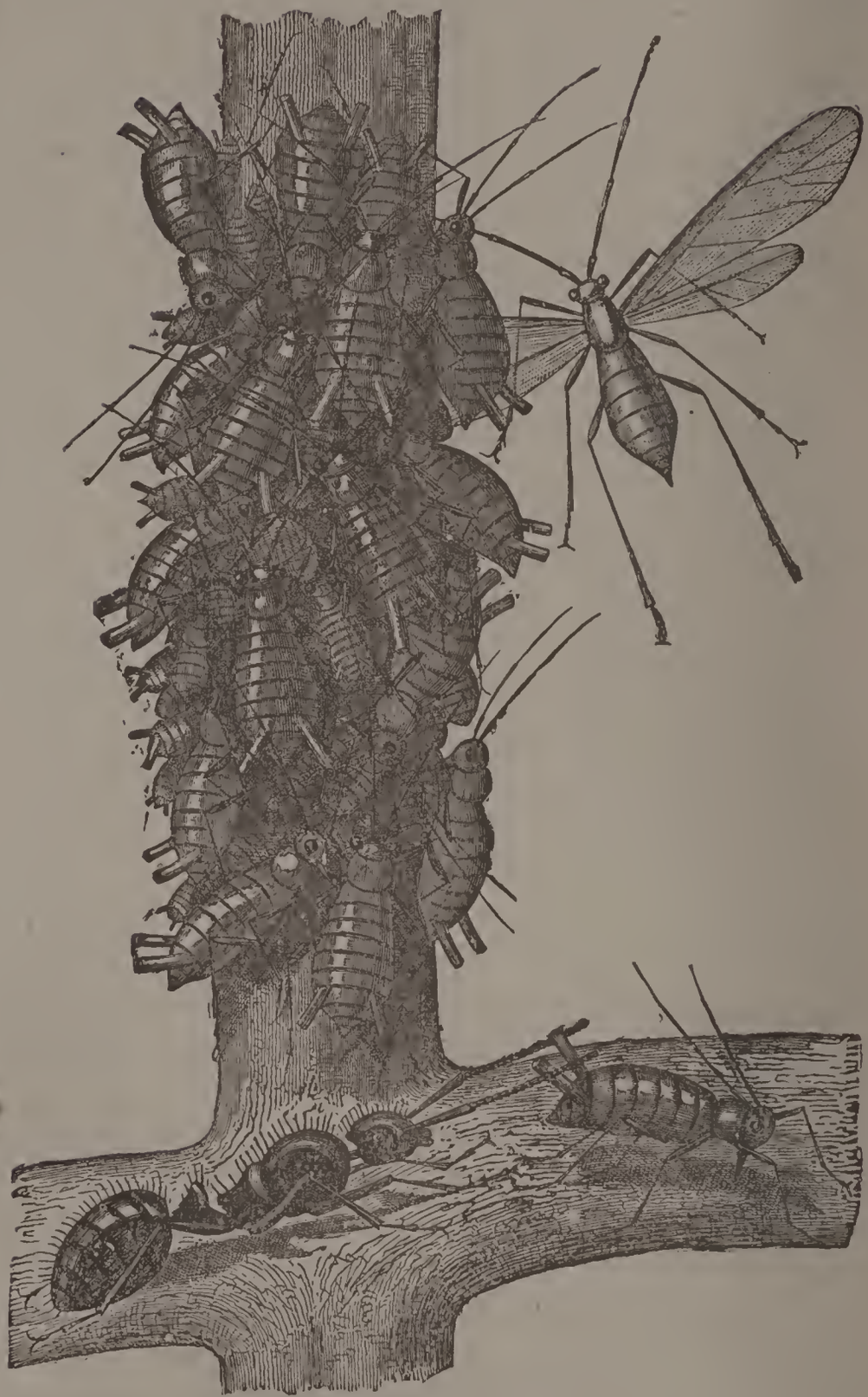
Now, from what has just been stated about the uniformity of their numbers, each time, it appears that from the liabilities of destruction during the long term of seventeen years, out of these five hundred embryos, only two appear certain of life and appearance in their perfect state, that is, just replacing the two parents. The chances of life therefore with this insect, are, in round numbers, two in five hundred. This calculation may seem strange to some, but if we reflect, it can scarcely be otherwise; for suppose the chances were double, that is, four in five hundred, then we should have at each time just double the numbers of their last time, which observation has shown to be untrue and which would augur much evil for the future condition of the vegetable world in the localities of their appearance. Even if their chances were three in five hundred, or half again the original stock, agriculturists would quickly perceive the difference.

To sum up the matter, then, we have here an insect whose economy and conditions of life are so unique that it is almost entirely isolated from human destructive agencies and which is obliged to deposit five hundred chances for the certainty of securing two. The ovaries have been formed with this capacity and the whole internal economy is of a corresponding character."

The shrill noise made by the male Cicada, "for," says Anacreon, "they all have voiceless wives," originates in two kettle-drum-like organs situated under the wings at the base of the hind body.

*The Aphis* (Fig. 24).—We should not be doing justice to the subject of garden pests if we omitted a special notice of that wonderful creature, the Aphis or Plant Louse. The first to appear in spring as the buds unfold, the very last to

FIG. 24.



Aphides and Ant.

desert their leafy homes in autumn, infesting every shrub, tree and herb, and not content to prey upon the leaves and bark, but even attacking the roots of annuals and trees alike, these little plagues are well nigh omnipresent.

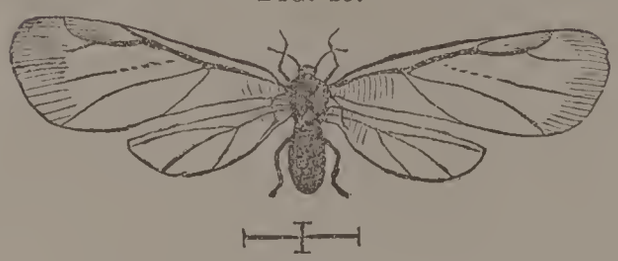
The naturalist Bonnet, as we have previously intimated, discovered in 1742 the singular mode of reproduction in these insects, by which we are enabled to account for their enormous numbers. He discovered that the summer brood of wingless individuals, or larvæ, were born of virgin mothers; that their progeny gave birth to similar aphides, and so on through the summer for nine generations, until the original maiden aphis counts her children and grandchildren by millions. This large family thus launched into the world are abundantly able to provide for their own wants without the slightest anxiety to the maternal heart. They at once, on being ushered into the world, plunge their long beaks into the leaf or twig on which they crowd, and there remain through their lives, leading a gluttonous existence indeed, for when their stomachs are full they do not have to rest awhile and sharpen their appetites for the next meal, or resort to emetics, as in the palmy days of Roman epicurism, but nature has provided them with two safety valves, being two little tubes situated on the end of the body. The liquid food or sap, after passing through the alimentary canal, in part overflows through these tubes, as a sweet exudation called honey dew. It may be seen dropping on leaves, and sometimes solidifies into a solid whitish sugar.

Aphides are thus a great source of attraction to ants and other insects, which visit them for the sake of this honey. Frequently the ants will stroke them and urge them to give out their honey more rapidly, hence they seem to milk them, and the aphides are regarded as the ants' cows. Some utilitarian ants treat them as domestic cattle, herding them, and even carry this care of their flocks so far as to take them up

in their jaws and carry them to a place of safety in their nests, if danger threatens.

The injury done by aphides is incalculable. The Wheat aphis at certain seasons, when extremely abundant, by its punctures, and the consequent loss of sap, causes the crop to diminish, the kernel being partly shrivelled and lessened in weight. The leaves of the elm, apple tree and currant are curled up, and the tree disfigured by them, while other

FIG. 25.



Pemphigus.

FIG. 26.

Larva of Syrphus.

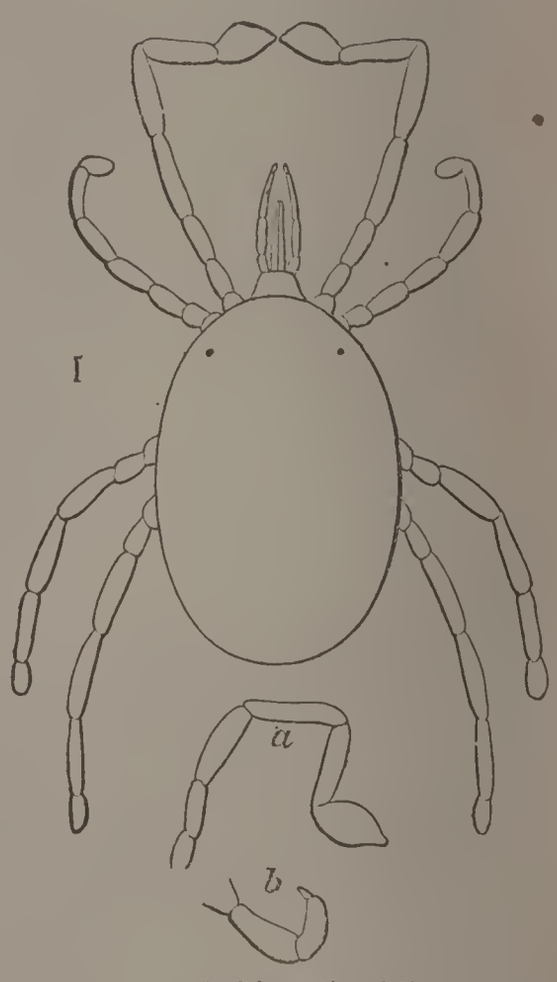
FIG. 26 *a*.

Syrphus Fly.

FIG. 27.

Lady-bird and young.

FIG. 28.




Aphis-eating Mite.

forms (Pemphigus, Fig. 25) produce gall-like swellings on leaves and the roots of trees. An instance where the same

species forms galls both on the roots and leaves of the same plant, is shown in the *Phylloxera vastatrix* of the grape vine, that fearful scourge of the vineyards of Europe and America.

Fortunately they have many enemies. The maggot of the Syrphus Fly (Fig. 26; 26 *a*, the fly), Lady birds (Fig. 27, larva, pupa and beetle) prey upon them very extensively; and certain small ichneumon flies (Aphidius), as well as other insects, certain mites, such as the form here figured (*Trombidium? bulbipes*, Fig. 28), and also some birds, must diminish their numbers.

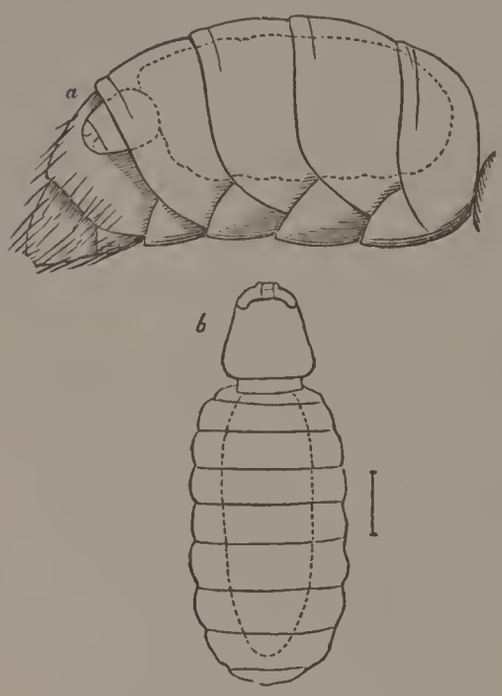
*The Scale Insect.*—Closely allied to the plant lice are the bark lice or scale insects, on which we will dwell for a moment. Imagine an animated oyster shell or shallow basin walking about on six slender legs, and we have the young bark louse. Let age effect its changes, the insect becoming stationary, the legs disappearing and its basin-like form glued to the bark of the tree, and it becomes still more like an oyster shell fastened to its native rock. Now compare with this bizarre form assumed by the female, the winged active male, and what a striking difference! and yet both were exactly alike in the larval state. What are the causes which have produced such a remarkable divergence between the two sexes? They are for the most part mysterious and beyond our comprehension, and yet by comparing the scale insects with other members of the family to which

FIG. 29.

Pine Scale Insect, Male, enlarged.

they belong, such as the mealy bug of our hot-houses or Cochineal insect of tropical countries and the Aleurodes, in which the sexual differences are less marked, and then comparing them with the aphides on the one hand, and on the other the Psylla, a member of another family closely allied, we are enabled to see that the changes in form have been undoubtedly induced by differences in habits, the kind of surface to which the scales are attached, the species of tree to which they belong, as well as to the different degree of mobility of the female; for the more she is fixed and immovable, the more active and lively is the male, just as in Stylops or bee-parasite, the female (Fig. 30) is remarkably different from the agile, volant male (Fig. 31). We may see in the aphis, where the two sexes are alike, that in their courtships the male finds its active partner in the ordinary movements of life, while since the female scale insect is immovable, its winged partner needs to be far more restless and swift in its movements than the male aphis; so that its chances of encountering its mate in the course of its travels, and thus providing for the continuance of the

FIG. 30.




Female Stylops

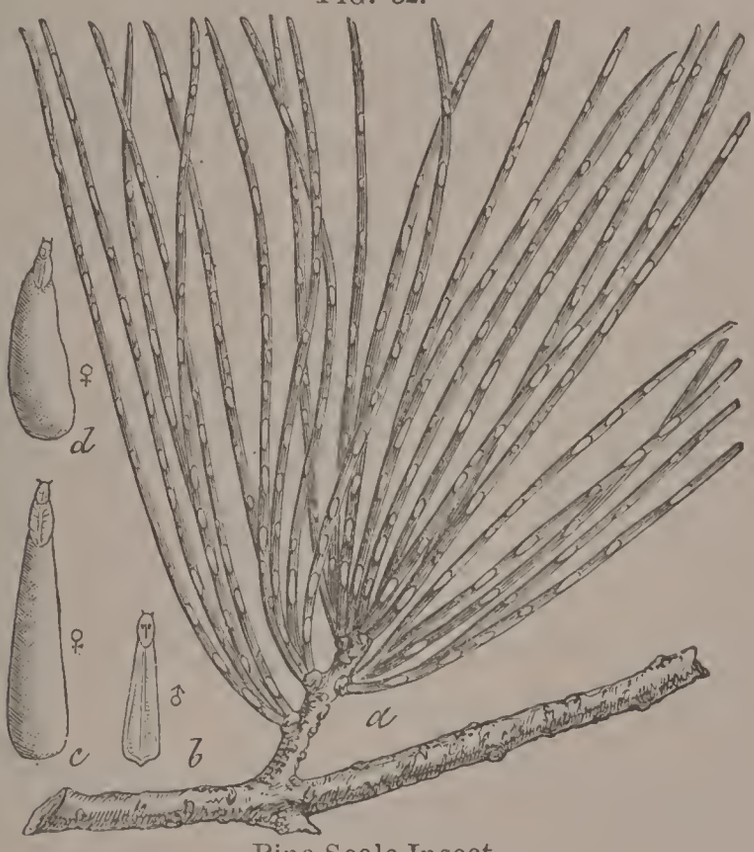
FIG. 31.

Male Stylops.

species, are greatly increased. We know from personal observation that these male scale insects do travel far from the trees on which their partners occur.

This leads us to regard this almost unnatural activity of the male scale insect as tending to prevent too close in-and-in breeding in the species. Nature in her wise and prudent forethought thus, instead of confining the sexes to one tree, so that cousins intermarry and the stock deteriorates, scat-

FIG. 32.




Pine Scale Insect.

ters these two-winged atoms, bearing them along on the wings of the wind and landing them in other groves and orchards, where they may intermarry with different races, and thus the species be restrained within the proper limits. Here we have another cause by which these sexual differences may have been produced.

Any one who has noticed these female scale insects clustering on an orange or ivy or oleander leaf, knows how much their form varies with that of the surface to which they are

attached. In the Pine-leaf Scale insect (Fig. 32 ; *a*, the leaves with the scales of natural size ; *b*, male scale ; *c*, female. Fig. 29, the male greatly enlarged, after Riley) the scale marked *d* is much wider than in the one marked *c*, which lives on a narrower needle of the pine. Indeed so great is the range of variation that when we regard the larva-like females, it becomes difficult to draw the limits between the species.

Nearly every tree of the orchard and our hard wood, deciduous trees harbor one or more kinds of scale insect. The oyster shell scale insect of the apple tree is an unfailing attendant and to young trees is extremely pernicious. The orange trees of Florida have been at times grievously afflicted by another species, while our ornamental shrubs and vines,

FIG. 33.


Parasite of Scale Insect.

and hot-house plants suffer greatly from their attacks. The injury they do is the result of their vast numbers, since they cluster on the leaves and stems of plants, puncturing the skin or bark and sucking the sap flowing beneath.

Happily they have their parasites, certain exceedingly small ichneumon flies, such as *Coccophagus* and *Aphelinus* (Fig. 33 ; *b*, antennæ, *c*, larva, all greatly enlarged, after LeBaron) which prey upon them. It is not rare to find a scale insect with a large round hole in the top of its body, through which the ichneumon has escaped. Mites are also known to prey upon their eggs.

*The Imported Currant Saw Fly.*—This dreadful pest of currant and gooseberry bushes affords an excellent example of the mode in which an imported animal flourishes far

beyond its natural limits when introduced into a new country, where its native insect parasites and bird enemies (if such there be) cannot reduce its numbers.

It was imported from Europe into nurseries at Rochester, New York, during the year 1860. It seems since that time to have spread westward and eastward, arriving in eastern Massachusetts about 1865, and since then has been very destructive in gardens in New England, including the eastern part of Maine.

The parent of this worm is a saw fly, so named from bearing a saw-like sting, or ovipositor, with which it pierces the leaves or stalks of plants, cutting a gash, in which it deposits an egg, the egg passing out from the ovary through the oviduct, and thence through the blades of the ovipositor into the wound made in the plant. While most of the members of this family cut a gash in the leaf, into which an egg is pushed, a few, as in the present insect, simply place them on the under surface of the leaf, as seen in Fig. 34. The fly has four wings, and belongs to the group of insects (Hymenoptera) that comprises the bee, wasp and ichneumon fly.

The following account of its habits is taken from the writer's "Guide to the Study of Insects:" "There are about fifty species of Nematus in this country, of which the most injurious one, the gooseberry saw fly, has been brought from Europe. Professor Winchell, who has studied this insect in Ann Arbor, Mich., where it has been very destructive, observed the female on the 16th of June, while depositing her cylindrical, whitish and transparent eggs in regular rows along the under side of the veins of the leaves, at the rate of about one in forty-five seconds. The embryo escapes from the egg in four days. It feeds, moults and burrows into the ground within a period of eight days. It remains thirteen days in the ground, being most of the time in the pupa state, while the fly lives nine days. The first brood of worms appeared May 21st; the second brood June 25th."

Figure 34, 1, shows the eggs deposited along the under side of the midribs of the leaf; 2, the holes bored by the very young larvæ; and 3, those eaten by the larger worms.

Figure 35 (*a*, enlarged) represents the worm when fully grown. It is then cylindrical, pale green, with a pale green head, while the segment next behind the head, and the third segment from the end of the body, together with the last or anal segment, are yellow; the sixteen false or abdominal legs are also yellow; the six thoracic legs are horn-colored. The body is transversely wrinkled, especially on the back, and is slightly hairy. The eyes and jaws (mandibles) are black, and on the inner side of the edge reddish. It is about three-quarters of an inch in length.

FIG. 34.

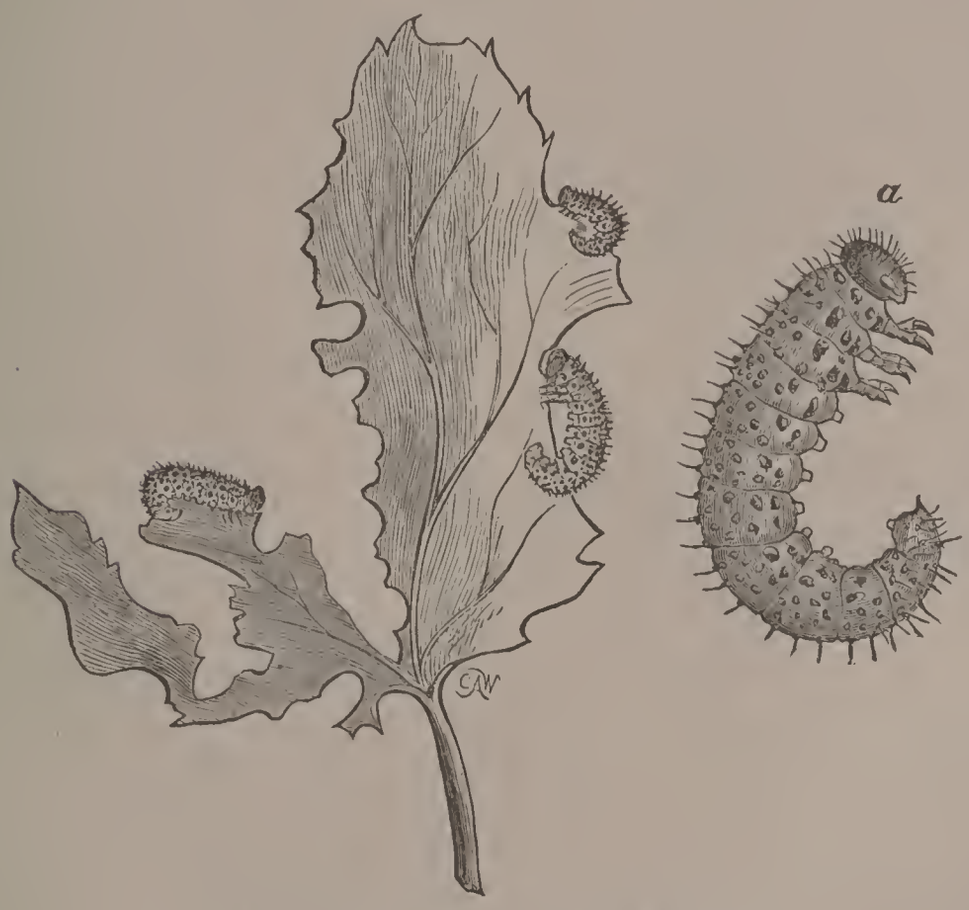

Eggs of Imported Currant Saw Fly.

Previous to the last moult, however, and before it has gained its full size, preparatory to passing into the adult or winged condition, the body is covered with black tubercles; from each of which arises a stiff black hair. There is also a supra-anal, or dorsal black patch on the last segment of the body, from which arises a pair of black spines. On the back of the false caterpillar the tubercles become smooth and transversely oval, and arranged in two regular rows. Moreover, a still more important characteristic of the worm in this state is the jet-black head, which in the fully grown insect is pale pea-green.

In the region of Salem they may be found late in May or

the first week in June feeding on the currants, and by the 8th of June they spin their cocoons, which are of silk, tough, dense, like parchment, and at first green, then becoming blackish, and covered with particles of dirt, and attached to the leaves in the breeding box. Here they remain between two or three weeks in June, the adult flies (in Salem) appearing June 25th. At nearly the same date (June 29th) the worms of the second brood were spinning their cocoons.

FIG. 35.




Larva of Imported Currant Saw Fly.

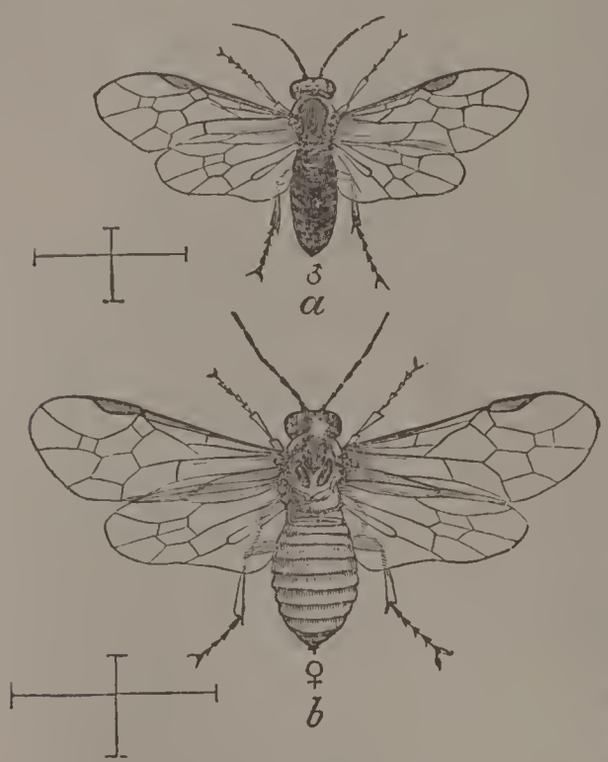
These cocoons (belonging to the second brood) remain under ground or on the leaves about the roots through the winter, the flies appearing in the spring and laying their eggs as soon as the leaves unfold.

Not having specimens of both sexes of this saw fly at hand I compile the following description (often using their own words) from Messrs. Walsh and Riley's account in the

"American Entomologist," Vol. 2, p. 16, from which these illustrations (Figs. 36 *a* and 36 *b*) are taken.

The female (Fig. 36 *b*) is a quarter of an inch long, and is of a bright honey-yellow color. The head is black, with all the parts between and below the origin of the antennæ, except the tip of the mandibles (jaws) dull honey-yellow. The antennæ are brown-black, often tinged with reddish above, except towards the base, and beneath entirely dull reddish, except the two basal joints. They are four-fifths as long as the body; the third joint, when viewed sidewise, is four times as long as wide; the third, fourth and fifth joints are equal in length, the remaining joints slowly diminishing in length. On the thorax are four conspicuous black spots, and other smaller ones. The legs are bright honey-yellow; the basal or hip joints (coxæ and trochanters) whitish, while the extreme tips of the hind shanks (tibiæ) and the whole of the hind toe-joints (tarsi) are blackish-brown. The wings are glossy, with dark veins, and expand a little over half an inch. She is known in Europe to lay eggs which have not been fertilized, and from which young caterpillars are hatched, as is sometimes the case with the silkworm and other moths, as well as other kinds of insects, including the honey bee.

FIG. 36.




Imported Currant Saw Fly.

The male (Fig. 36 *a*) is rather smaller (a fifth of an inch in length), and is black. The head is dull honey-yellow. The antennæ are brown-black, often a little reddish beneath,

except towards the base; they are as long as the body, and while longer than in the female are also somewhat flattened out. The thorax has the wing-scales and the prothorax, or collar, honey-yellow. The under side and tip of the abdomen are honey-yellow.

The injury done to currant and gooseberry bushes is very great. They strip the bushes, eating the leaves down to the leaf-stalk, myriads clustering upon the branches. The birds evidently do not feed upon them, and thus in dealing with this insect we are deprived of one of the most powerful agencies in nature for restraining a superabundance of insect life. We can scarcely realize the amount of good done to the farmer and gardener by insectivorous birds.

As this is an important and practical subject, let us digress for a moment, to notice some facts brought out by Mr. J. J. Weir, a member of the London Entomological Society, on the insects that seem distasteful to birds. He finds by caging up birds whose food is of a mixed character (purely insect-eating birds could not be kept alive in confinement), that all hairy caterpillars were uniformly uneaten. Such caterpillars are the "yellow bears" (Arctia and Spilosoma), the salt-marsh caterpillars (*Leucarctia acræa*), the caterpillar of the vaporer moth (Orgyia), and the spring larvæ of butterflies; with these may perhaps be classed the European currant saw fly. He was disposed to consider that the "flavor of these caterpillars is nauseous, and not that the mechanical troublesomeness of the hairs prevents their being eaten. Larvæ which spin webs, and are gregarious, are eaten by birds, but not with avidity; they appear very much to dislike the web sticking to their beaks, and those completely concealed in the web are left unmolested. When branches covered with the web of *Hyponomeuta evonymella* (a little moth of the Tinea family) were introduced into the aviary, those larvæ only which ventured beyond the protection of the web were eaten." "Smooth-skinned, gaily-

colored caterpillars (such as the Currant Abraxas, or span worm), which never conceal themselves, but on the contrary appear to court observation" were not touched by the birds. He states, on the other hand, that "all caterpillars whose habits are nocturnal, and are dull-colored, with fleshy bodies and smooth skins, are eaten with the greatest avidity. Every species of green caterpillar is also much relished. All Geometræ, whose larvæ resemble twigs, as they stand out from the plant on their anal prolegs, are invariably eaten." Mr. A. G. Butler of London has also found that frogs and spiders will not eat the same larvæ rejected by birds, the frogs having an especial aversion to the currant span worms (Abraxas and Halia).

The natural enemies of the Currant Saw Fly are three kinds of ichneumon flies, of which one is a minute egg-parasite. Mr. Lintner, of New York, states that of fifty eggs laid by the parent saw fly, only four or five hatched out the currant worm. We see, then, that though the birds apparrently destroy none, an immense number are carried off, even before they have a chance of doing any mischief, by minute insects of their own order.

One of the best remedies next to picking them off by hand, and which is really the most practicable method of getting rid of them, is to dust powdered white hellebore over the bushes, by sprinkling it from a muslin bag tied to a stick, as it otherwise excites violent sneezing. Used in this small quantity it is not poisonous. This is the remedy used with most success in the west, and recommended by Messrs. Walsh and Riley. A solution, consisting of a pound of copperas to six gallons of water, has been used with much success. It blackens the leaves, but does not injure them permanently. Also suds made of carbolic soap is perhaps a better remedy.

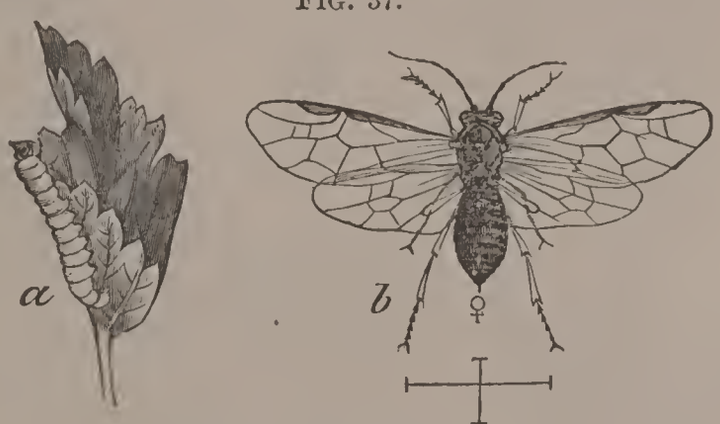
Dr. E. Worcester, of Waltham, according to the "Boston Journal of Chemistry," finds that this worm "may be fully

and almost immediately destroyed by the use of carbolate of lime. The doctor tried the powder in many instances during the past summer, and found that while it was fully as effective as hellebore, it was less disagreeable, less costly, and perfectly safe. The method of using it is to sprinkle it over the bushes as soon as the worm makes its appearance, bringing it well in contact with the leaves, and soon the insect is destroyed. It will need but two or three applications, and the work is done."

This worm attacks the gooseberry as well as the currant, though in Massachusetts its ravages have been more confined to the latter shrub. As a preventive measure against its farther spread, in buying or transporting gooseberry and currant bushes, Walsh recommends that the roots be carefully cleaned of dirt, so that the cocoons may not be carried from one garden or nursery to another.

*The Native Currant Saw Fly.*—As this species may be confounded with the European saw fly, though belonging to

FIG. 37.




Native Currant Saw Fly.

a different genus (*Pristiphora*), the following brief account of it is extracted from my "Guide to the Study of Insects."

This saw fly (Fig. 37 *a*, larva; *b*, female, from the "American Entomologist;" *P. grossulariæ* of Walsh) "is a widely diffused species in the northern and western states, and injures the currant and gooseberry. The female fly is shining black, while the head is dull yellow, and the legs are

honey-yellow, with the tips of the six tarsi, and sometimes the extreme tips of the hinder tibiæ, and of the tarsal joints, pale dusky for a quarter of their length. The wings are partly hyaline, with black veins, a honey-yellow costa, and a dusky stigma, edged with honey-yellow. The male differs a little in having black coxæ. Mr. Walsh states that the larva is a pale grass-green worm, half an inch long, with a black head, which becomes green after the last moult, but with a lateral brown stripe meeting with the opposite one on the top of the head, where it is more or less confluent; and a central brown-black spot on its face. It appears the last of June and early in July, and a second brood in August. They spin their cocoons on the bushes on which they feed, and the fly appears in two or three weeks, the specimens reared by him flying on the 26th of August." This worm may at once be distinguished from the imported currant worm by the absence of the minute black warts that cover the body of the latter. The same remedies should be used against this worm as were recommended for the imported saw fly.

*The Currant Span Worm* (Fig. 38, moth; Fig. 39, 1, 2, caterpillar, 3, pupa). — Many persons in speaking of the "currant worm" confound the caterpillar-like saw fly larva with the well-known geometer caterpillar, which is a native species, and was long since described by Dr. Fitch, under the name of *Abraxas ribearia*. As soon as the leaves of the currant are fairly expanded, late in May or early in June, the young caterpillars, scarcely thicker than a horse-hair, may be found eating little holes in them. In about three weeks after hatching, it becomes fully grown; it is about an inch long, and bright yellow in color, the body being covered with large black dots. The chrysalis is shining

FIG. 38.

Currant Span Worm Moth.

reddish-brown, about half an inch long, and may be found late in June, either upon the ground or just under the surface. In two weeks after entering the chrysalis state the moth may be observed flying about the garden, or resting upon the leaves during cloudy weather. The moth is yellow ochreous, with dark, often nearly transparent blotches on the wings.

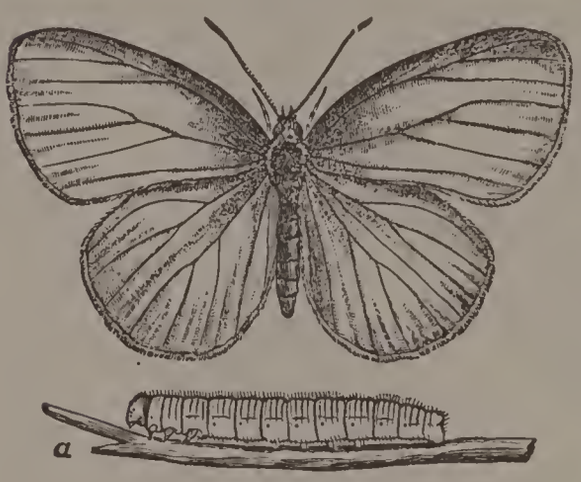
FIG. 39.


Currant Span Worm and Pupa.

It is not easily mistaken for any other moth. Mr. Riley, in an article on this insect in the "American Entomologist," states that by sprinkling powdered hellebore upon the leaves, or applying a solution of eight or twelve ounces to a bucketful of water, the caterpillars will be killed. Hand-picking assiduously followed up, and a vigorous shaking of the bushes over a sheet, or newspaper, repeated twice a day will keep this insect within moderate bounds.

*The European Cabbage Butterfly.*—It is interesting to compare the habits of the imported butterfly with those of our native species. We have two kinds of white Cabbage butterflies which have never done much harm to our cabbage and turnip crops. The first of these is the common white Northern Cabbage Butterfly, *Pieris oleracea* of Harris (Fig. 40, *a*, larva). We have found the larvæ of this species on turnip leaves in the middle of August, at Chamberlain farm in northern Maine. They are of a dull green, and covered with dense hairs. When about to transform they suspend themselves by the tail and a transverse loop, and their chrysalides are angular at the sides and pointed at both ends (Harris). The butterfly is white, with the wings dusky next the body, the tips of the fore wings are yellowish beneath, and the hind wings are straw-colored beneath. The yellowish, pear-shaped, longitudinally ribbed eggs are laid three or four on a single leaf. In a week or ten days the larvæ are hatched. They live three weeks before becoming full-fed. The chrysalis state lasts from ten to twelve days. There is an early summer (May) brood and a late summer (July) brood of butterflies.

FIG. 40.




Native Cabbage Butterfly.

While this kind feeds on the leaves of the cabbage and turnip, the Southern Cabbage Butterfly (*Pieris Protodice*), when in the caterpillar state, feeds on the outer leaves of the cabbage plant. It is often destructive in market gardens in the middle and southern states. But the injury done by our aboriginal butterflies is slight indeed compared with that resulting from the European species, which is usually

unchecked by its ichneumon parasites or by birds, which are preserved in Europe, where with us they are either brutally murdered, or neglected if allowed to live.

The European Cabbage butterfly (*Pieris rapæ* Schrank) is, however, a hundred fold more formidable insect, as it is fearfully abundant where it occurs, and the caterpillar feeds inside of the cabbage head when forming.

It was introduced from Europe to Quebec about the year 1857, having been captured in 1859 by Mr. Bowles, of that city. It rapidly spread into New England along the different railroads leading in from Canada, and is now common about Boston and New York and has reached Washington. About Quebec it annually destroys $250,000 worth of cabbages, according to the Abbé Provancher. It is evident that, in this newly arrived insect, we have another formidable pest added to our list of imported insects.

The male butterfly (Fig. 41) is white, with the tips of the fore wings black, dusted with white, while on the fore wings is a single, and in the female (Fig. 42) there are two large black spots, situated two-thirds of the distance from the base to the outer edge of the wing. It expands about two inches. The female lays her eggs singly on the under side of the leaves. The caterpillar (Fig. 43, *a*) is green, and so densely clothed with minute hairs as to be velvety; it has a yellowish stripe down the back, and another along each side, the belly being of a paler, brighter green; it is often more than an inch long, and about as thick as a large crow-quill. It changes in September under some board or stone, to a chrysalis, suspended by a thread spun over the back, as shown at Fig. 43, *b*. It is of a pale flesh-brown color, freckled with black. It does not appear to have been very destructive in Europe, but, like other introduced species, it suddenly becomes a fearful scourge. The best remedies are evidently hand-picking when the caterpillars can be seen, and the capture of the butterflies by means of a light gauze

net mounted on a wire ring a foot in diameter, and attached to a short pole. Affected cabbage heads should be carefully examined, and if much infested by worms, be burnt, for if they are suffered to lie about the garden after being pulled up, the caterpillars will attack the other plants.

A correspondent of the "American Agriculturist" for November, 1870, states that "it is estimated that the loss from this insect will, in the vicinity of New York [city] alone, exceed half a million of dollars; and already the price of cabbages has advanced." He says that Mr. Quinn, the owner of a large plantation, "has found carbolic powder, superphosphate and lime together, to destroy them. The carbolic powder appears to be sawdust impregnated with carbolic acid. Salt has been recommended, but Mr. Quinn did not find dry salt efficacious, though lime has been reported by others as useful."

FIG. 41.

Imported Cabbage Butterfly, male.

FIG. 42.

Imported Cabbage Butterfly, female.

FIG. 43.


Caterpillar and Chrysalis.

Mr. C. S. Minot, in an interesting article entitled "Cabbage Butterflies," in the "American Entomologist," vol. 2, strongly recommends destroying the chrysalis, which may be found under chips, boards, stones, etc., and advises that boards, raised two inches above the surface of the ground, be placed among the plants to attract the caterpillars when about to change to a chrysalis.

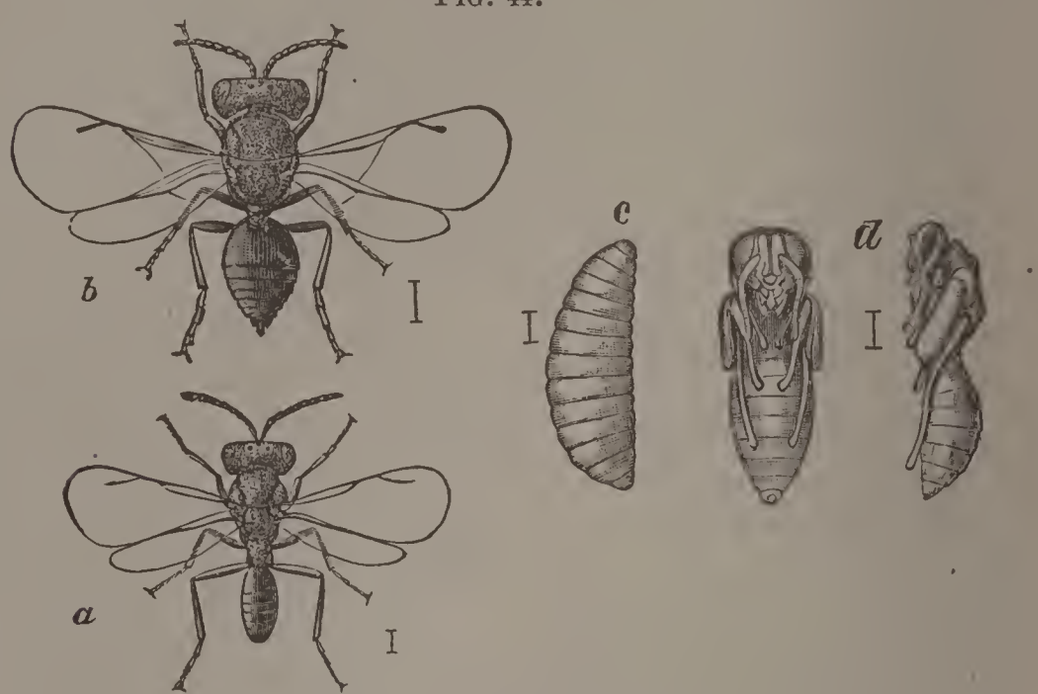
Mr. Curtis has described and figured several parasites of the three species of cabbage butterflies found in England, and he shows how thoroughly they keep in check these troublesome worms. Certain minute ichneumon flies (Chalcids) lay their eggs in those of the butterflies. Another Chalcid fly (*Pteromalus brassicæ*) lays its eggs on the outside of the chrysalis of the White Cabbage Butterfly (*Pieris brassicæ*), and sometimes two or three hundred of the little Chalcid maggots have been found living riotously within a single chrysalis. They turn into minute brilliant flies, which multiply in excessive quantities. Mr. Curtis remarks that "some species of this extensive genus (*Pteromalus*), probably comprising nearly one thousand species (!) swarm even in our houses, especialy in the country, where in October and November I have seen immense numbers inside of the windows, and I believe that they hibernate behind the shutters, in the curtains, etc."

Fortunately for the prospects of American gardeners, we have a parasite (Fig. 44 *a*, male; *b*, female; *c*, larva; *d*, pupa) which already carries off large numbers of the caterpillar. Lately, in the middle of September, Mr. F. W. Putnam handed me one hundred and ten chrysalides of the butterfly, all but two of which were infested by these parasites in both the larval and pupa states; while from other chrysalides the adult Chalcid flies were emerging. They continued to emerge until late in the autumn. The infested chrysalides of the butterfly could be easily distinguished by the livid and otherwise discolored and diseased appearance of the body,

while those unattacked had preserved their fresh color, and the tail moved about readily, the diseased ones becoming stiff and more or less dried. Mr. Putnam thinks that at least two-thirds of the chrysalides of this butterfly, hundreds of which had in the early autumn suspended themselves about his house and fences, had been attacked by these useful allies.

On opening the body of the infested chrysalides I found about thirty parasites in different stages of growth, in one case thirty-two, in another only twelve. We can readily see

FIG. 44.




Parasite of Cabbage Butterfly

how efficient these minute insects become in reducing the numbers of their hosts. A large proportion of the Pteromali undoubtedly winter over in the body of the chrysalis, the adult insects appearing in the spring. In England Mr. Curtis found the fly in June, so that evidently there is an autumn and spring brood of Chalcid flies.

The male of this Pteromalus is a beautiful pale-green fly, with the body finely punctured and emitting metallic tints; the abdomen, or hind body, is flat, in dried specimens with

a deep crease along the middle of the upper side, and it is much lighter in color and with more decided metallic reflections than on the rest of the body. The antennæ are honey-yellow, with narrow black wings. The legs are pale honey-yellow. It is from one-twelfth to one-tenth of an inch in length.

The body of the female, which would be thought at first to be an entirely different kind of insect, is much stouter, broader, with a broader oval abdomen, ending in a very short ovipositor, while the underside of the body near the base has a large conical projection. It is much duller green than the male, and the body is more coarsely punctured. The scutellum of the metathorax is regularly convex, not keeled, in both sexes. The antennæ are brown, and the legs brown, becoming pale towards the ends, the ends of the femora (thighs) being pale; the tibiæ are pale-brown in the middle, much paler at each end, while the tarsi are whitish, though the tip of the last joint is dark. It is from a line to a line and a third in length. It differs from Harris' *Pteromalus vanessæ* in the little piece known as the scutellum of the metathorax being smooth, not keeled, and by its darker legs.

The larva is a little white maggot about a sixth (·17) of an inch in length. The body consists of thirteen segments, exclusive of the head, and is cylindrical, tapering rapidly towards the head, while the end of the body is acutely pointed. The chrysalis is whitish, the limbs being folded along the under side of the body, the antennæ reaching to the end of the wings; the second pair of legs reaching half-way between the end of the wings and end of abdomen; while the tips of the third pair of feet reach half-way between the second pair of feet and the end of the abdomen. It is from a line to a line and a third in length.

This invaluable ally of the gardener is one of the chalcid family of Hymenoptera, and was long ago described by Linnæus under the name of *Pteromalus puparum*, from the

fact that it inhabited the pupæ, or chrysalides, of butterflies. This insect has been known to inhabit this country since 1844, as there are specimens in the British Museum taken in Hudson's Bay Territory in that year; so that it is probably indigenous to both countries, while its present host in North America is the imported cabbage butterfly introduced in 1857.

I have found that another parasite attacks this insect, as the larva of a species of Tachina (Fig. 45) occurred in the body of a caterpillar. Doubtless others will eventually be found to take up their abode in the body of this insect. It would be interesting to learn whether the birds prey upon the butterfly or caterpillar, and whether they assist in reducing the number of these pests. We can but hope that the present enormous numbers of these worms will, as soon as the insect becomes fully domesticated, be held in check by the united efforts of gardeners and the natural enemies of the insect.

FIG. 45.

Tachina larva.

As the worm eats the interior of the cabbage or cauliflower it is difficult to deal with. Something can be done by showering the heads with a solution of carbolic acid or strong soap suds, but it is better to employ hand picking, and when the plants are hopelessly infested to throw them on a hot fire. If fed to animals the worms will manage somehow to escape.

*The Cabbage Web-moth.*—Another destructive insect, which is almost cosmopolitan in its distribution, is a little green caterpillar, which at times so abounds on the outer leaves as to threaten the destruction of whole fields of cabbages. It is most abundant in a warm and unusually dry season. Dr. Fitch was the first to observe it in Illinois during the year 1855. He named it *Cerostoma brassicella*, but it is undoubtedly the well known European *Plutella xylostella*, and first described by Linnæus. Though the insect has been

observed in this country only late in the summer and in September, when the cabbages have headed, yet these worms, as Dr. Fitch suggests, probably belong to a second brood. Mr. H. T. Stainton, in his excellent "Manual of British Butterflies and Moths," states that the moths fly in May and August, while the caterpillars appear in June, July, and a second brood again in September. Dr. Fitch suspects that the first brood of caterpillars may feed on the young cabbage plants in early summer, and thus do more mischief than in the autumn, when the heads are fully formed.

The caterpillar is a little pale green worm, with small, stiff, dark hairs scattered over the body; it is a quarter of an inch long. When about to transform it spins a beautiful open net-work of white silken threads, forming a cocoon (Fig. 46*) open one at end; it is a third of an inch long.

FIG. 46.

*a*

Cabbage Web-moth and cocoon.

The moth itself (Fig. 46 *a*) is pale gray, with the head, palpi and antennæ white, but the latter are ringed alternately with white and gray on the outer half. The rest of the body is gray, except on the under side, and on the middle of the thorax, where there is a broad, white, longitudinal band, which when the wings are folded is continuous with the white band along the inner side of the wings. The two front pair of legs are gray, with the tarsal joints ringed narrowly with white; the hind legs are whitish and hairy. The fore wings are gray, with a conspicuous, broad, longitudinal, white band along the inner edge, and extending to the outer third of the wing; this band sends out three teeth towards the middle of the wing, the third tooth being at the end of the band. There is a row of dark dots

*This and figure 44 are from my "Report on the Injurious Insects of Massachusetts," and are kindly loaned by Mr. C. L. Flint, Secretary of the Massachusetts Board of Agriculture.

along the outer edge of the stripe; a row of blackish dots along a pale shade just outside of the front edge of the wing, and two rows of blackish dots diverging upon the tip or apex of the wing. The fringe is marked with a few dark spots. The middle of the wing next the white band is darker than the front edge, while a faint yellowish shade runs along the middle of the outer half of the wing towards the tip, enclosing a few black dots. It expands a little over half an inch.

Should young plants be attacked by the worms, the best remedy would be to shower them with soapsuds. For the autumnal brood of worms the plants should be plentifully showered; and if this is not efficacious, the worms should be picked off by hand, the cocoons especially.

*The Garden Leaf Roller.*—One of the most intelligent and industrious of our garden pests is the leaf-rolling caterpillar, which as soon as the leaves unfold in the spring begins to draw them together in an ingenious manner by silken threads, in order to make a rude sort of domicile where it may live hidden from the sharp eyes of its feathered and insect enemies. By the first of June its presence in the terminal shoots of the apple, the rose, and other shrubs, together with the strawberry, may be detected by the crumpled and distorted mass of leaves at the end of the shoot, or, if the strawberry plant, by the leaves being sewed together in a tangled head.

How is the following problem in mechanics to be solved? How does the tiny worm pull the leaves together, and sew them into a rude sort of tube or tent? The little creature begins by spinning a thread and attaching one end to some fixed point, and then attaching the other to the loose leaf. By means of the powerful muscular movements of the front part of the body, and like a sailor, except that our caterpillar uses its teeth (it is doubtful if the fore legs assist in the operation) it hauls away on the rope of silk, slowly pulling it up to the desired point, where it is held in place by a new

and shorter thread. Finally, after much labor, the young caterpillar (for it begins its work soon after hatching from the egg) spins a number of threads, each of which adds new strength to the tubular structure, until a tent arises—the whole the work of perhaps but a few minutes. In this tent it resides, enlarging it as its body grows, and eating out the interior, adding new stores of food by sewing new leaves to the outside of the tent, until, when about to pass into the chrysalis state, it stops eating. It does not now desert its home. Its tent serves it as a rude cocoon, the caterpillar having previously lined it with silk, and we often find the end of the chrysalis protruding out of the door of the tent after the moth has flown away.

FIG. 47.

Leaf-roller.

This species of leaf-roller, called *Lozotœnia rosaceana* by Dr. Harris (Fig. 47, enlarged twice), is rather large compared with others of its family, its body rather plump and pale livid green, its head is black, as is also the ring following; while the other segments are transversely wrinkled above, with a few scattered fine hairs. The moth itself usually appears about the last of June. From its eggs laid at this time a new brood of worms appear in August. The pupa or chrysalis is pointed on the top of the head, and on the hinder edge of each abdominal ring are two rows of spines. The moth is pale brown, with two broad oblique darker reddish brown bands across the fore wings, and a triangular spot of the same color near the tip. The hind wings are ochreous yellow. The wings expand about an inch, and the caterpillar is a little less than an inch long. There are many other leaf-rolling caterpillars which roll up leaves much more perfectly than the Garden Leaf-roller. No one has described their mode of building their tubular houses better than the celebrated French philosopher and naturalist, Réaumur. We may find on some of our trees leaves rolled up much like those here figured from Réau-

mur's work entitled "*Mémoires pour servir a l'Histoire Naturelle des Insects*," and which are copied from Figuier's work "The Insect World."

Figure 48 represents an oak leaf which has been partially

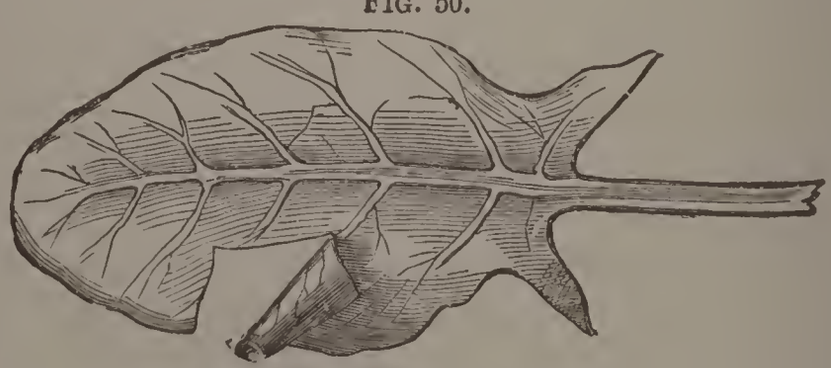
FIG. 48.

FIG. 49.

Oak leaf rolled perpendicularly and sidewise.

rolled up transversely. We can see with what care the leaf has been rolled up, and how at each step the roll has been secured by bundles of silken strands. A similar roll is seen

FIG. 50.



Sorrel leaf cut by a caterpillar.

at figure 49, where the leaf has been rolled sidewise or longitudinally to the leaf, with the same painstaking. Another species Réaumur found to roll a portion of a sorrel leaf, cut-

ting it away from the side of the leaf, and then deftly rolling it up into a slender cone, which stands up nearly on its base

FIG. 51.

FIG. 52.

Willow leaves rolled by a caterpillar; and section.

(Fig. 50). An example of a less perfect roll, and one intermediate in perfection between the foregoing nests and the tent of the common garden Tortrix, is shown in the accompanying figure (51) of a number of willow leaves rolled up by a caterpillar, while figure 52 gives a transverse section of the same compound roll with the outer threads binding the simple rolls into a bundle. Our garden leaf-roller can

be best subdued by hand picking. It is easy to detect the tents, and a simple matter to remove the worm and crush it under foot.

*The Leaf Cutter Bee.*—The leaves of the rose bushes in the garden are sometimes strangely cut into, as if some fairy had overnight deftly cut them with her wanton scissors. To

FIG. 53.

The Leaf Cutter Bee and nest.

many this fact is a sore puzzle. It is due to a leaf-roller of quite a different sort from any we have before considered. The figure (53 after Figuier) represents the Leaf Cutter Bee cutting out a circular piece of leaf with her scissors-like jaws, while the nest, composed of numerous pieces variously folded and pressed together, attests her wonderful skill and forethought.

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